SF 8.1

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August 16, 1983

Mr. Michael Johnston, Chief
Air Operations Section
U.S. EPA Region X M/S 532
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Johnston:

In response to your letter of August 5th, I have given some additional thought as to how to approach the issues facing you. I believe that the objectives you have described, i.e., apportionment of arsenic impacts, community exposure source apportionment and dispersion model validation, are reasonable, given a realistic level of funding, careful planning and a strong team approach.

As I mentioned during our conversation, the key to success in these programs is a well thought out study design phase which, I now believe, would benefit greatly by inclusion of a source characterization effort. Once the characteristics of the emission sources are known, the feasibility and exact level of source apportionment can be defined for both process and fugitive emission sources. In my view, the question is not whether a source apportionment study is feasible, as it is what level of source resolution detail you require.

The following estimates are intended to provide you with a preliminary approximation of likely costs and time for tasks designed to achieve your objectives. Actual costs and scheduling need to be better defined in the planning phase after we have discussed, in much greater detail, the project objectives and available resources. For example, I'm sure we can make considerable use of the source apportionment work PSAPCA is sponsoring in Tacoma.

Project Overview

Figure 1 outlines an integrated program plan that encompasses each of the NESHAPS, Superfund and model validation objectives you have described. Each of the four objectives is shown in this Figure, which can be read as a flow graph diagram to accomplishing each objective. To accomplish all four objectives, the total project budget is likely to total between $350-450,000 over a 20 month period. Please note that the following costs are only

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estimates at the present time. Each of the major program elements are briefly described below. Tasks 1 and 2 together compromise the proposed Study Design Phase, a total of $70,000 that needs to be committed before a full study design and feasibility analysis can be completed. The full study would consist of Tasks 1-7, with Tasks 2-7 likely to be refined during the Study Design Phase.

Task 1: Program Design ($30,000, 4 months)

This first phase of the program provides an opportunity to carefully consider, document, coordinate and cost out alternative study design options and the probability of project success. Given the importance of the issues involved and the multiple objectives that have been discussed, this phase should produce written proposals for the most cost-effective study design(s).

Task 2: Source Characterization ($40,000, 3 months)

This source characterization task will provide information essential to project planning and feasibility analysis and should begin about 1 month into the program design phase.

The intent of the source characterization tasks is to (a) obtain size-resolved aerosol samples respresentative of each major ASARCO emission point and (b) chemically analyze the samples to obtain source "fingerprint" data required by the receptor modeling programs (Tasks 3 and 4). These measurements will not provide the emission rate information required by NESHAPS Objective 1. They are, however, highly important to designing a receptor modeling study that will achieve maximum resolution of the ASARCO sources. For example, we must know more about the chemical and physical properties of the low level fugitive sources if we are to be successful in pinpointing their impact.

Results should be incorporated into the program plan. Costs are listed in Table 1. Based on the results of Tasks 1 and 2, EPA can make a "go/no go" decision on the remaining tasks.

Task 3: Personal Exposure Monitoring ($35,000, 10 months)

Given the importance of fugitive dust sources of arsenic, direct application of receptor modeling techniques to personal monitor samples is essential to development of credible results since the ambient site data will probably not be representative of personal exposure levels. Costs and assumptions are shown in Table 2. Ambient air monitoring sites which meet SLAMS/NAMs siting criteria are, after all, specifically sited to avoid fugitive dust sources. The public, and especially children, are likely to be exposed to these fugitive sources much differently than are ambient monitoring site equipment. This task would develop personal monitoring data for key represenatives of the population (worker, child, housewife, others) to determine whether such receptors provide a different arsenic source apportionment result than when

SLAMS/NAMS monitoring sites are treated as the receptor. Both source-receptor apportionment approaches would be able to estimate the contributions from the various arsenic sources (process and fugitive) because of the source characterizations "fingerprints" generated in Task 2.

Task 4: Ambient Air Program ($194,000 12 months)

Table 3 is a listing of the main Tacoma airshed and ASARCO particulate sources. In the last column, I have indicated those sources which should be rather easy to resolve given currently available information. The sources indicated as more difficult to resolve will be those that are relatively small emitters (i.e. fragmentizer), those emitting nondescript aerosols (elemental carbon from distillate-fired boilers) and those of unknown composition. Although the literature (Small, et al., and Germani, et. al.) seems to indicate that the differences in elemental profiles between smelters (main stack--not low level fugitives) is sufficient to permit resolution, I know of no fugitive emission composition data for the Tacoma smelter that would provide a basis for judging the feasibility of apportioning these sources. Completion of Task 2 is therefore of central importance to the successful conduct of the ambient air program.

ASARCO yard fugitives can be easily distinguished from arsenic enriched soils in and around the community by "lacing" open areas with an artifical tracer. Only extremely small quantaties of these materials are needed as X-ray flourescence methods can detect them at very low levels. Without an artificial tracer, our hope for resolving yard dust from community soils is greatly diminished.

Results from the proposed ambient apportionment study (Task 4) will meet NESHAPS Objective #2 by providing arsenic apportionment for the fine, coarse, PM-10 and TSP fractions at five locations during summer and winter periods. Results will also support NESHAPS Objective #1, estimation of arsenic emission rates by source, and serve as a basis for the model validation tasks. Assumptions and approximate costs are noted in Table 4.

Regarding the practicality of analyzing existing filters, there are a number of reasons that new samples should be collected. Chemical analysis of historical hi-vol filters for receptor modeling is not recommended by EPA ESRL OR OAQPS--primarily because of blank filter impurities, artifact sulfate formation and tendency for smaller particles to become imbedded in the filter matrix. For these reasons, analysis of old hi-vol filters would severely damage the programs credibility. Receptor model studies based on size-resolved samples are the current state-of-the-art and have been proposed here. In addition, concurrent upper air, surface winds and emissions data need to be collected at a sufficient number of sampling sites if the study is to be used for model validation. These criteria cannot be met if the study design is constrained by the use of historical filters.

Task 5: Meteorological and EI Data Base ($35,000, 10 months)

If the receptor model results are to be used to validate dispersion model impact estimates, surface and upper air meterological data for selected days must be gathered, reduced and processed for model imput. Particulate and SO_2 emissions inventory data bases perferably based on 1 KM resolved area source emissions, should be developed specifically for the validation days of interest. If a grid model is to be applied, wind flow fields may also need to be generated and topography coded. Cost details noted in Table 5 do not include flow field generation or topography coding. Development of a validated arsenic model incorporating fugitive dust sources would be of great value in assessing personal exposure levels, control strategy options and community health assessment.

Task 6: <u>Dispersion Modeling</u> ($30,000, 7 months)

This task involves completion of dispersion modeling computer runs to "back calculate" process emissions, given source impacts (receptor model) and meteorology. In these runs alternative emissions rates for arsenic sources would be used with receptor model results (Task 4), literature information, and jugement to select best estimates for various arsenic source emission rates. The resulting arsenic emission rate estimates can be compared to material balance-derived emission rates to meet NESHAP Objective #1. Although this approach is not as certain as direct, Method 5 measurements, it does provide an alternative approach to costly direct source tests and should be further evaluated during the design phase. Cost and assumptions are noted in Table 6.

Task 7: <u>Model Validation</u> ($40,000, 6 months)

Region X's dispersion model validation objectives include access to a validated particulate (TSP and PM_{10}) and arsenic model as well as an SO_2 model suitable for evaluating PSD increment impacts. Each of these objectives can be achieved by completion of this receptor/disperison model validation task, using the source apportionment results from Task 4, the meterological and EI data bases completed under Task 5 and the disperison model results developed under Task 6.

The first step requires validation of dispersion model particulate impact estimates for those source groups that are (a) easily quantified by receptor modeling and (b) are major SO_2 emission sources. Dispersion model impact estimates are then compared to receptor modeling results for the same time period, results are evaluated and corrective action taken if needed to improve the dispersion model's performance. Following particulate model validation, a "hands off" simulation of SO_2 emissions can be compared to actual ambient SO_2 measurements as a test of the model's credibility for SO_2.

Once validated for particulate impacts, the dispersion model's application to SO_2 simulations assumes: (a) SO_2 is non-reactive and (b) the SO_2 and particulate emissions disperse in a similar manner. A second, more in-depth validation of the model for SO_2, would require concurrent particulate/SO_2 measurements during Task 2 and concurrent SO_2 measurements at the receptor sites, providing a suitable data base for direct SO_2 apportionment by the receptor models. This approach is more costly (about $40,000) but would provide a higher level of confidence in the model's SO_2 simulations. This approach is not included in the costs noted in Table 7.

Project Benefits, Costs and Scheduling

Completion of Tasks 1-7 will provide EPA with the supporting data bases and a validated dispersion model capable of calculating impacts within the Tacoma airshed of the major sources of particulate and SO_2 emissions, including both process and fugitive emissions of arsenic from the ASARCO smelter, and arsenic from reintrained soils off the ASARCO plant site. EPA will also have results from state-of-the-art source and receptor models (based on ambient monitoring sites or personal monitors as receptors), and the capacity of evaluating various SO_2 particulate/arsenic impacts. These tools will enable EPA to apportion current source impacts and to estimate the effects of control strategies on pollutants levels, not only at fixed monitoring sites, but also in terms of the personal exposure of key classes of people (worker, child, etc.). The latter has obvious use in any arsenic health risk assessment studies. Such estimates always entail uncertainities, the magnitude of which would be estimated in the proposed study, but can not be estimated now. The information/tools proposed in this study should greatly reduce the current levels of uncertainity regarding the relative magnitude or source impacts. Table 8 summarizes the overall project costs, likely schedule requirements, and the level of confidence in the results. Note that the study design phase (Tasks 1 and 2) at about $70,000 is required to address all of your objectives. Once the tasks are completed, the incremental cost to address any other objective is substantially reduced. For example, if the NESHAPS 2 is funded, incremental cost increase to achieve NESHAPS Objective 1 is reduced to about $65,000 since Tasks 1,2 and 4 are common to both efforts. The full study cost estimates noted in Table 8 reflect all of the cost to achieve the objectives note based on a critical path interpretation of Figure 1. Total costs to complete all of the objectives will be at least $400,000. All cost estimates presented here are preliminary.

Regarding project scheduling, my estimate is indicated that about 1 1/2 years will be needed to complete all of the objectives--primarily because of the six month (summer, winter) air and personal exposure sampling period requirement. This time frame could be shortened if the study focused on only winter periods. Experience has shown that studies of this magnitude require a lot of time to complete. We anticipate completion of several interim reports during the study, highlighting critical results and directing on-going tasks.

Given time and resources as indicated here, the program as outlined should have an excellent probability of providing a high quality, state-of-the-art study that will support regulatory decisions. I am somewhat cautious of the prognosis for NESHAPS Objective #1 because it is based on a variety of dispersion model and meterological assumptions that may be uncertain. Although our approach to this objective seems sound, to my knowledge no studies have been done to prove the feasibility of estimating emission rates using dispersion models.

Project Management

In light of the importance of this project to EPA, the best approach that Region X can take is to involve a strong team of nationally recognized experts in the fields of Chemical Mass balance, factor analyis, X-ray diffraction, scanning electron microscopy, dispersion modeling, source characterization, personal exposure monitoring and data analysis. We recognize the need to develop a strong team of consultants in each of these areas to insure the credibility of the program's results, and are fully capable of retaining the necessary experts. Our role in this work would include program management, responsibility for field operations, data management, quality assurance, dispersion model validation and other tasks. Assistance with source characterization, factor analysis, XRD, ASEM, analytical and other tasks would be subcontracted from recognized experts we have worked with in the past. Our extremely low overhead rates (40.5%) will allow us to subcontract the necessary work while maintaining maximum program credibility at minimal expense. Further, as a certified 8(a) firm, Region X has easy access to us through the Small Business Administration, thereby minimizing possible time delays. Current project activities require about one-half of my time over the next three months, so I can be available to work with you on this project.

I hope this information is responsive to your August 5th letter and that it will help you in developing your program. If I can provide you with further clarification or a specific cost quotation on any of these tasks, please advise. We appreciate your interest in working with us.

Very truly yours,

NERO AND ASSOCIATES, INC.

John E. Core, Manager
Air Quality Group

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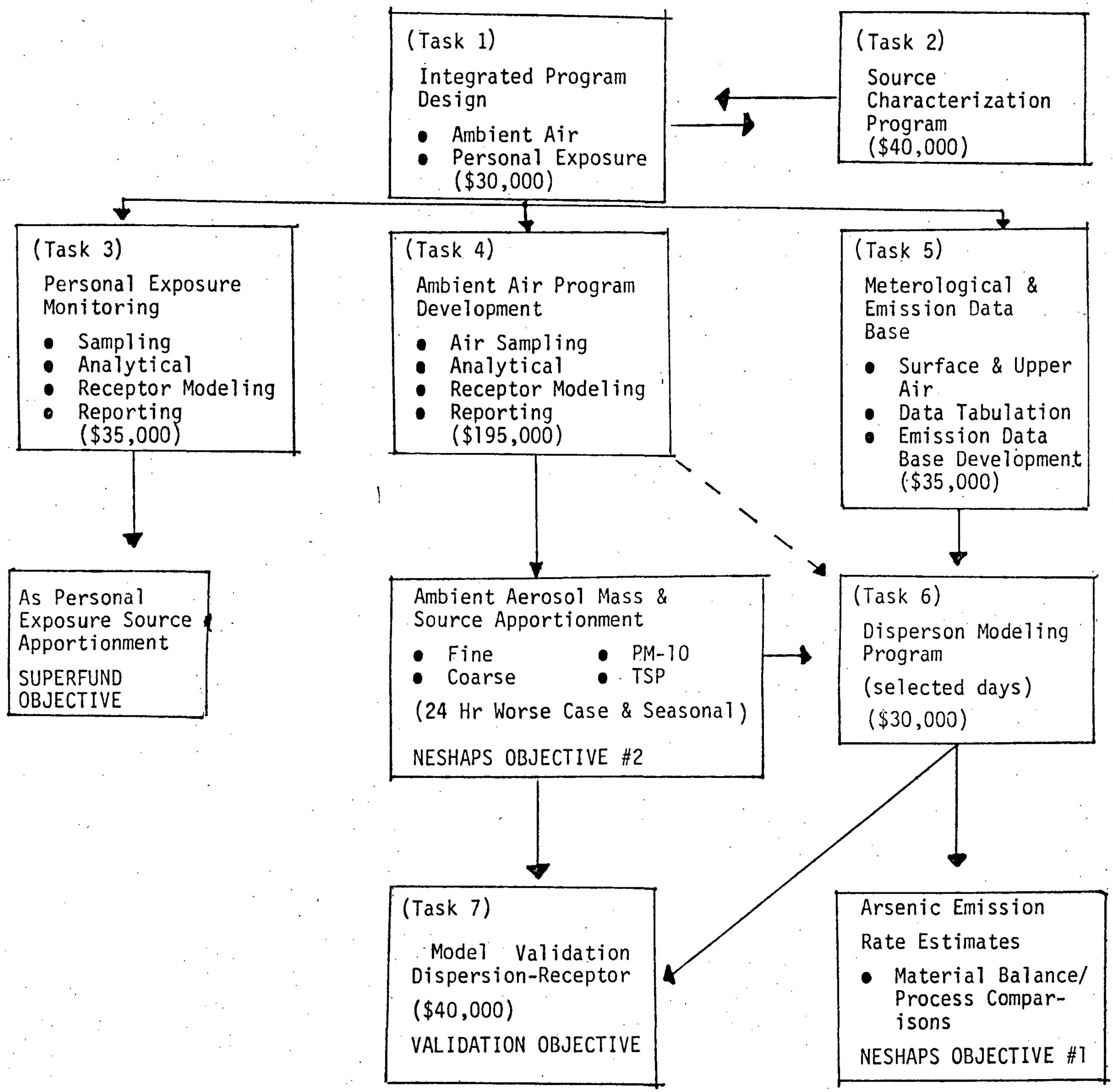

FIGURE 1

Integrated Program Plan

($350,000-450,000)

TABLE 1

Source Characterization Program

Assumes:

Emission Characterization of the following ASARCO sources

- o Main Stack
- o Converter Building Fugitives
- o Slag Dump Fumes
- o Slag Dust Fugitives
- o Yard Soils
- o Reverberatory Fugitives
- o Arsenic Building
- o Community Soils

- o Reintrainment to fine, coarse, and TSP samples (dust sources and soils)
- o Replicate sample sets (10 to 3 sets per sources)
- o Trace element, carbon and ion analysis of all samples
- o XRD and ASEM analysis of 30 filter sets
- o Neutron activation analysis (QA) on 30 filter sets
- o Reporting

Approximate Costs:

o	Analytical	$ 29,200
o	Direct Labor (testing)	8,000
	(reporting)	3,000
o	Mileage/per diem	1,000
o	Materials	2,000
	Total	$ 43,200
	Project Cost Range	$40,000-50,000

TABLE 2

Personal Exposure Assessment Program

Assume:

- Personal monitoring equipment is provided
- Evaluation of 10 subjects, 24 hour exposure periods, 1 week period
- Summer and winter sampling periods
- Trace element analysis of all samples (XRF)
- ASEM, XRD analysis of 20% of samples
- Receptor modeling (CMB) all samples
- Reporting

Approximate Costs:

Analytical	$ 12,000
Receptor modeling	4,000
Mileage, per diem	300
Materials	200
Direct Labor	12,000
Computer	1,000
Consultants	3,000
Reporting	2,500
Total	$ 35,000

Project cost range $25,000-$40,000

TABLE 3

TACOMA AIRSHED EMISSION SOURCES

Source Group	Source Name		% of TSP	Basis for Apportionment	Confidence in Results*
Combustion					
Residual Oil	St. Regis Paper Pennwalt Chemical, Occidental Chemical		2.4%	91 % of V emitted by residual oil (tracers)	5
Hogged Fuel Boiler	St. Regis Paper, others		34.0%	93% of K, 92% of Cl emitted by this source (tracers)	5
Distillate Oil Boilers	U.S. Oil		0.4	Elemental Carbon, sulfur--minor source	2
Process Losses					
Wood Fiber	N. Pacific Plywood		4.5%	Optical microscopy	3
Veneer Dryers	N. Pacific Plywood		0.3%	Organic Carbon (minor source)	0
Aluminum-Potlines	Kaiser Aluminum		14.6%	95% of airshed F (tracer)	5
-Alumina	Kaiser Aluminum		8.1	ASEM, XRD or CMB	3
Asphalt Batching	Woodworth & Co.		0.1%	} too similar to soils to apportion	0
Rockcrushing	Woodworth & Co.		2.5%		
Gypsum	U.S. Gypsum		1.8%	Easily identified by XRD	5
Lime Production	Tacoma Lime		9.2%	Easily identified by XRD	5
Pulp & Paper- Kraft Furnace	St. Regis Paper		7.8%	Strong emitter of $Na_2SO_4 \cdot 2H_2O$	3
-dissolver tank	St. Regis Paper		1.1%	unknown characteristics	0
Cement Production-Dust	Glacier Sand & Gravel		1.2%	identify by CMB or XRD	3
Metals Recovery-Fragmentizer	General Metals		0.3%	} principally Fe (minor source)	1
-incinerator	General Metals		0.2%		
Copper Smelting-main stack	ASARCO	about	4. %	proportions of Cu, As, Se, Cd, S	4
-converted bldg.	" "	" "	3. %	unknown	?
-slag dump	" "	" "	10. %	slag fugatives identified by XRD	5
-As bldg.	" "	" "	1 %	As rich, single constitute source	?
-Reverb	" "	" "	2 %	unknown	?
-Ore fugatives	" "		?	CuS easily identified by XRD	5
-Yard fugatives	" "		?	} Laced with tracer	5
				Without tracer	2
Transportation					
Auto exhaust			0.3%	Pb, Br	4
County airport			0.1%	Elemental Carbon (minor source)	0
Road dust/soils			8.2%	Proportions of Si, Al, Fe, Ca	5

*Scale of 0-5; 0 indicating no confidence; 1=little probability; 2=fair probability; 3=good probability; 4=very good probability; 5=100% confidence

Table 4

Ambient Air Monitoring Program

Assumes:

- Five sampling sites operated over a six month period with two additonal months start-up, shutdown time
- Sampling for fine, coarse and TSP fractions
- Summer (3 months) and winter period (3 months) program
- Collection of 3,000 samples; analysis of 1,000 selected samples (trace metals, carbon, ions, XRD, & ASEM)
- Capital equipment (all air samplers, parts)
- Computer costs, mileage and per diem (10 trips)
- Full time air monitoring technician, 8 months
- Electrical power
- Outside consultants in XRD, factor and ASEM analysis
- Receptor modeling (CMB) with reporting

Approximate Costs:

o	Capital equipment (rental)	$ 7,000
o	Analytical costs	82,450
o	Materials, parts	4,000
o	Computer	6,000
o	Mileage/per diem	5,000
o	Direct Labor	50,000
o	Consultants	40,000
	Total	$194,450

Project cost range $150,000-250,000

TABLE 5

Meterological and Inventory
Data Base Development

o Direct Labor

Collect and reduce met data	$ 10,000
Area Source EI development	15,000
Point Source EI data base	10,000
Total	$ 35,000

Project cost range $25,000-40,000

Table 6

Dispersion Modeling

Assumes:

- o Availability of dispersion model suitable for use in the Tacoma airshed
- o Funding and completion of Tasks, 1,2,4, and 5.

Approximate Costs:

o	Direct Labor	$15,000
o	Computer	5,000
o	Consultant	9,500
o	Per diem and mileage	500
	Total	$30,000

Project Cost Range $25,000-$35,000

Table 7

Dispersion Model Validation

Assumes:

- SO_2 model validation based on intercomparison of particulate impacts of major SO_2 sources. Does not include SO_2 source measurements.

- Availability of meterological and SO_2 data bases (Task 5), suitable dispersion model (Task 6) and source apportionment results (Task 4).
- Availability of continous SO_2 ambient air data for the Tacoma airshed on selected days.
- Evaluation of receptor/dispersion impact estimates for major SO_2 emission sources; analysis of dispersion model input errors; data base improvements to optimize validation results and independed (hands-off) validation of the model against ambient SO_2 measurements.

Approximate Costs:

Direct labor	$ 19,500
Computer simulations	5,000
Mileage/per diem	500
Consultants	16,000
Total	$ 40,000

Project Cost Range $30,000-50,000

TABLE 8

PROJECT FEASIBILITY SUMMARY

	Study Design Phase+		Full Study Phase		
Study Objectives	elapsed time	estimated cost	elapsed time	estimated cost	Confidence in Results*
NESHAPS 1[(a)]	4 mons.	$70,000	18 mons.	$330,000	2.5
NESHAPS 2[(b)]	4 mons.	$70,000	16 mons.	$265,000	4.0
SUPERFUND[(c)]	4 mons.	$70,000	13 mons.	$105,000	4.0
MODEL VALIDATION[(d)]	4 mons.	$70,000	20 mons.	$370,000	3.5

NOTES:

Requires Completion of Tasks

(a) 1,2,4,5,6

(b) 1,2,4 (likely level 3 confidence in ability to apportion each major ASARCO source; level 4 confidence in apportion airshed tsp mass)

(c) 1,2,3

(d) 1,2,4,5,6,7

0-5 Scale; See Table 3 Footnote

\+ Only needs to be funded once if multiple objectives are desired.